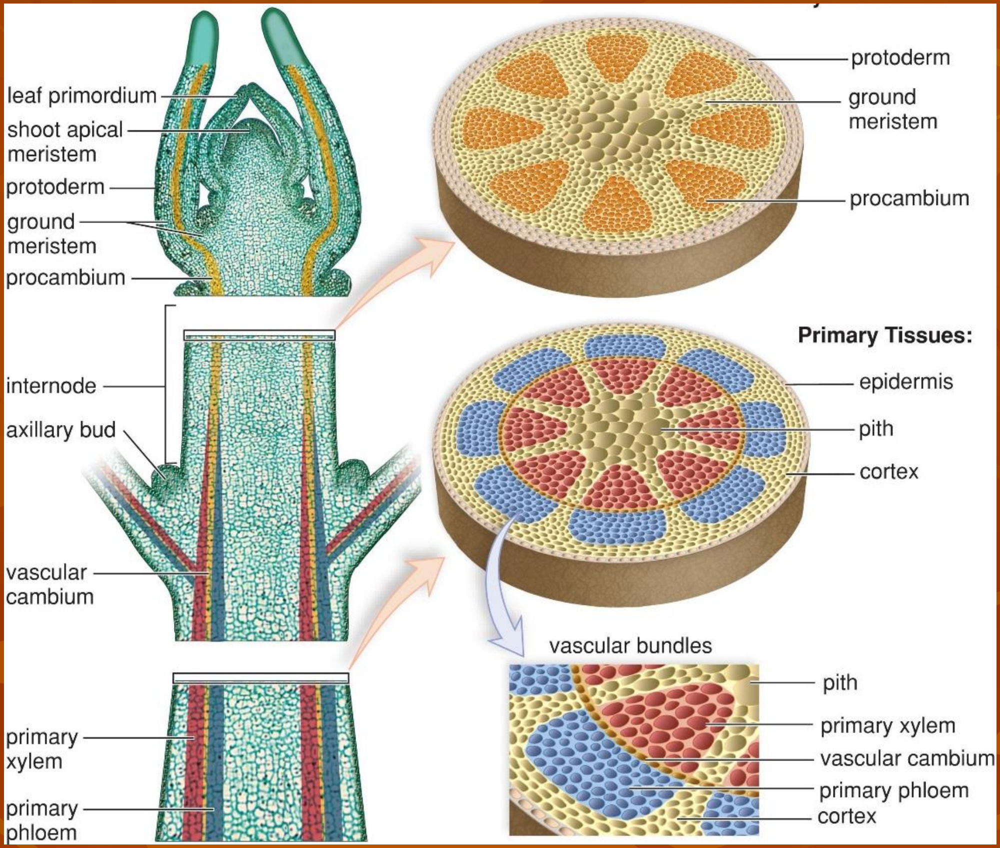
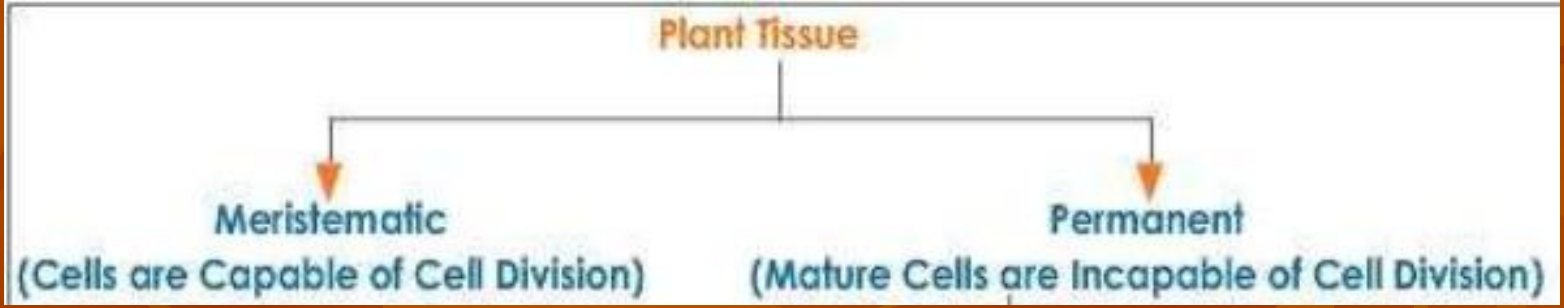
PLANT TISSUES



Plant Tissues

- Groups of similar or dissimilar cells that have same origin and perform a coordinated function form tissue.
- ***Types of Plant Tissues***.



Plant Tissue

Meristematic
(Cells are Capable of Cell Division)

Permanent
(Mature Cells are Incapable of Cell Division)

Meristem

- Meristem is derived from Greek word “Meristosis” meaning to divide.
- Unspecialised dividing tissue, responsible for maximum growth and organogenesis

Characters

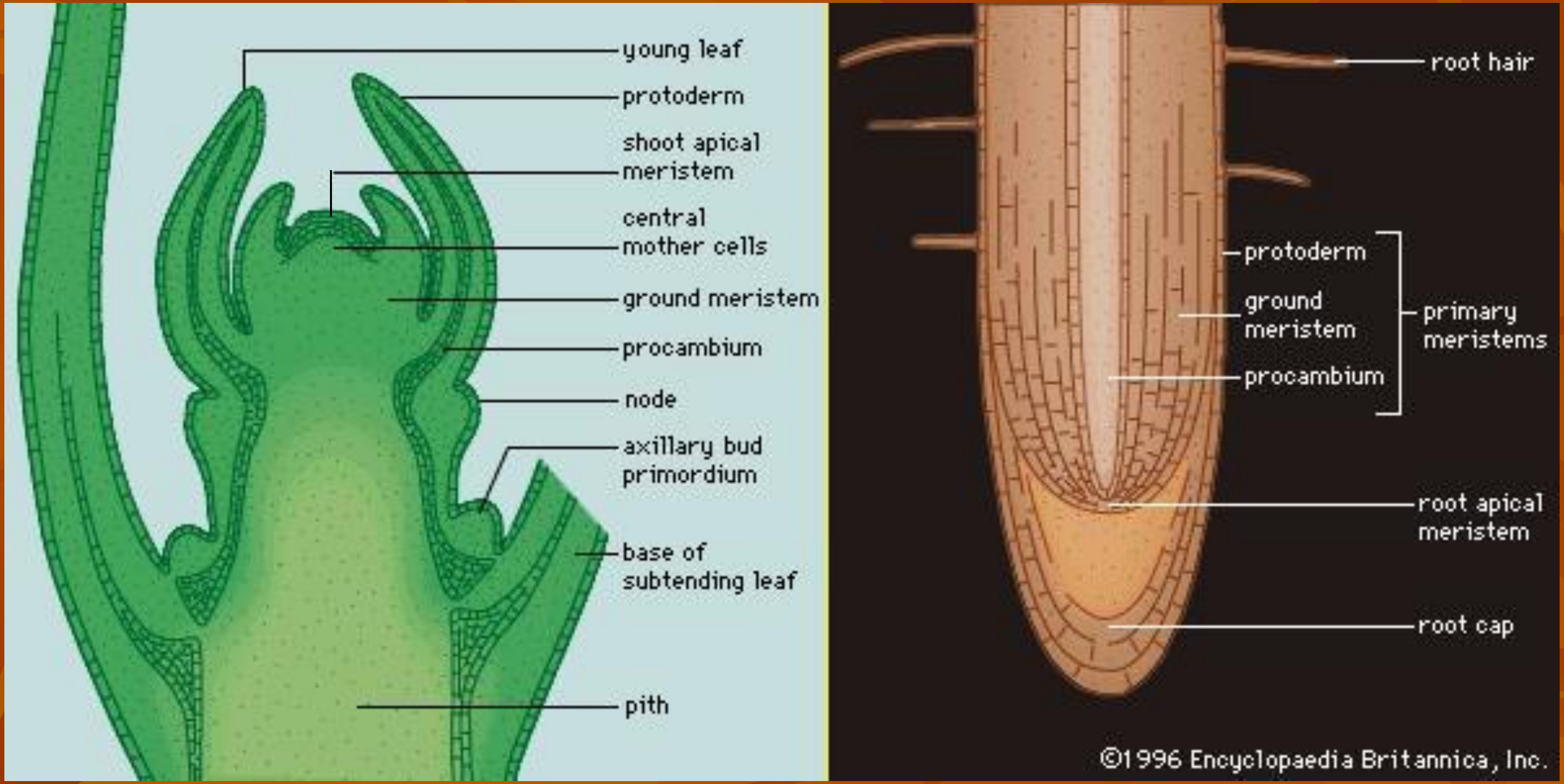
- Localised in growing regions
- Isodiametric
- Thin cell walled (Primary)
- Vacuoles small or absent
- Lack intercellular space

Classification of Meristem

- Based on location
- Based on origin
- Based on differentiation (part formed)

Based on Location (or Position) in the Plant Body

*Apical meristem *Intercalary meristem *Lateral meristem



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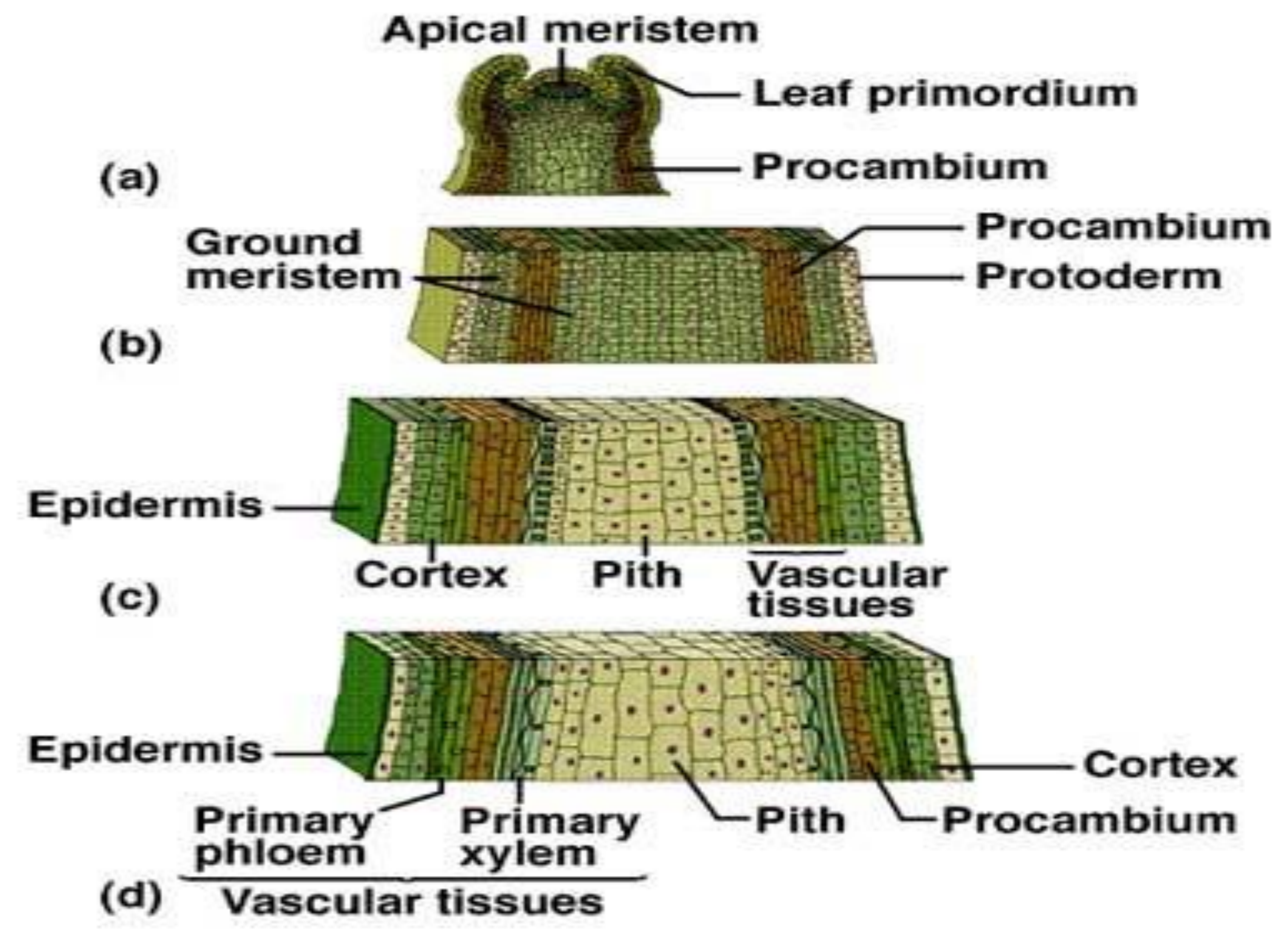
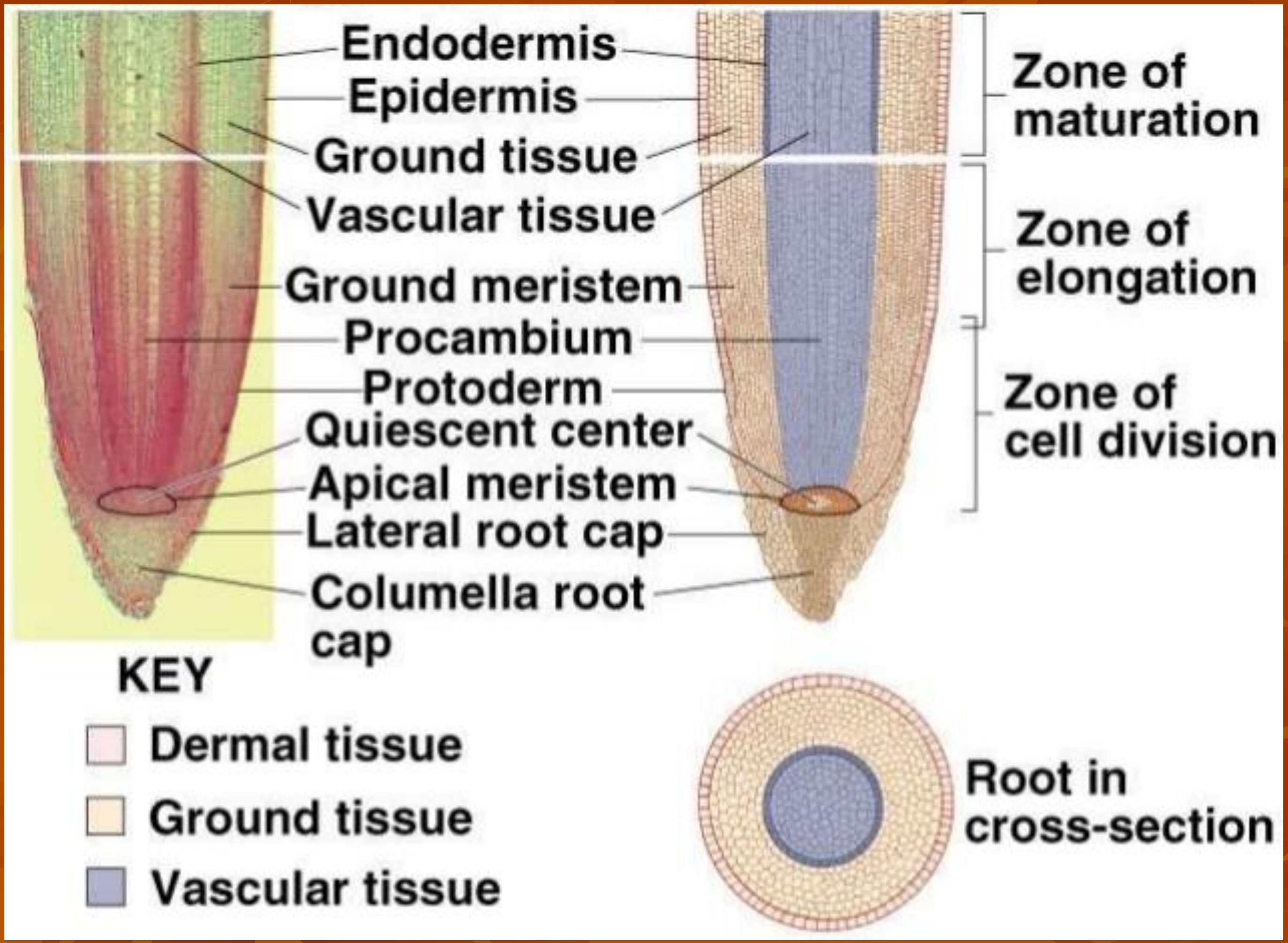
Apical Meristem

- It is the meristem present at the tip of the root and stem, commonly called as root apex and shoot apex respectively.
- Such meristems constitute the actively growing regions in the plant body.
- Due to the activity of apical meristem the plant body keeps increasing in its length

Shoot Apical Meristem

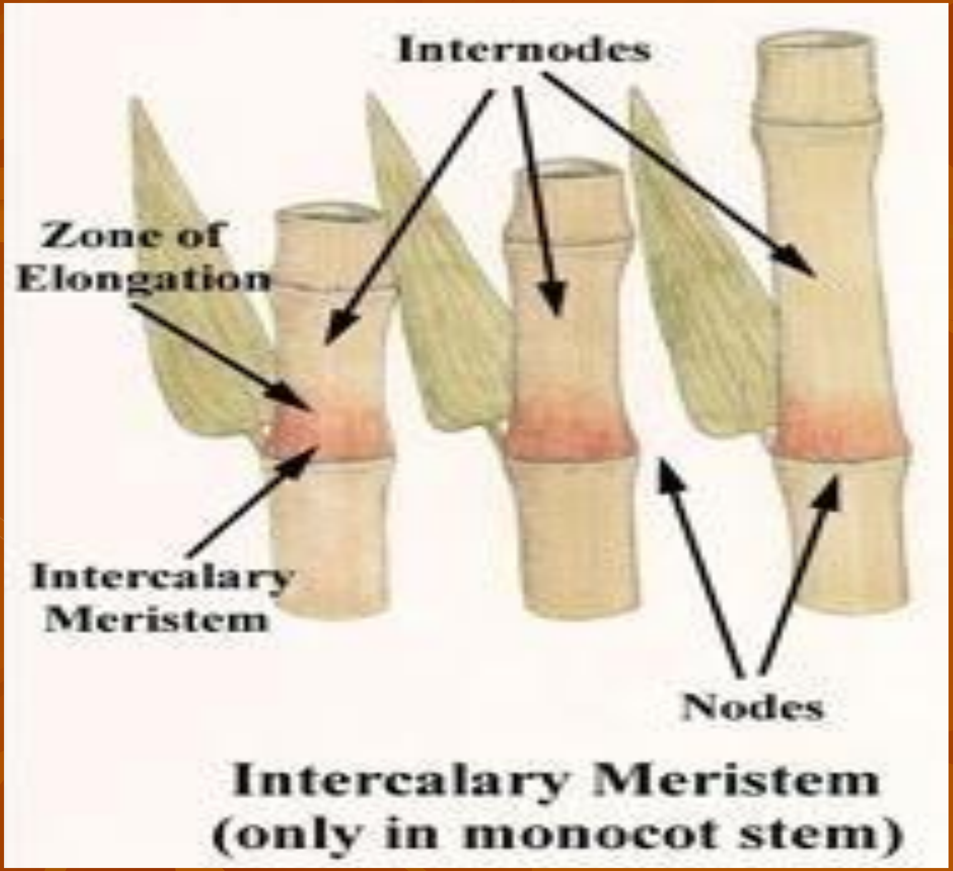


Root Apical Meristem



- ***Root apical meristem is subterminal,*** covered by a root cap.
- ***Quiescent centre*** is a patch of inactive tissue present within root apical meristem region. It has non-dividing/very slowly dividing cells. It can take over root formation process if surrounding tissues are damaged.

Intercalary Meristem

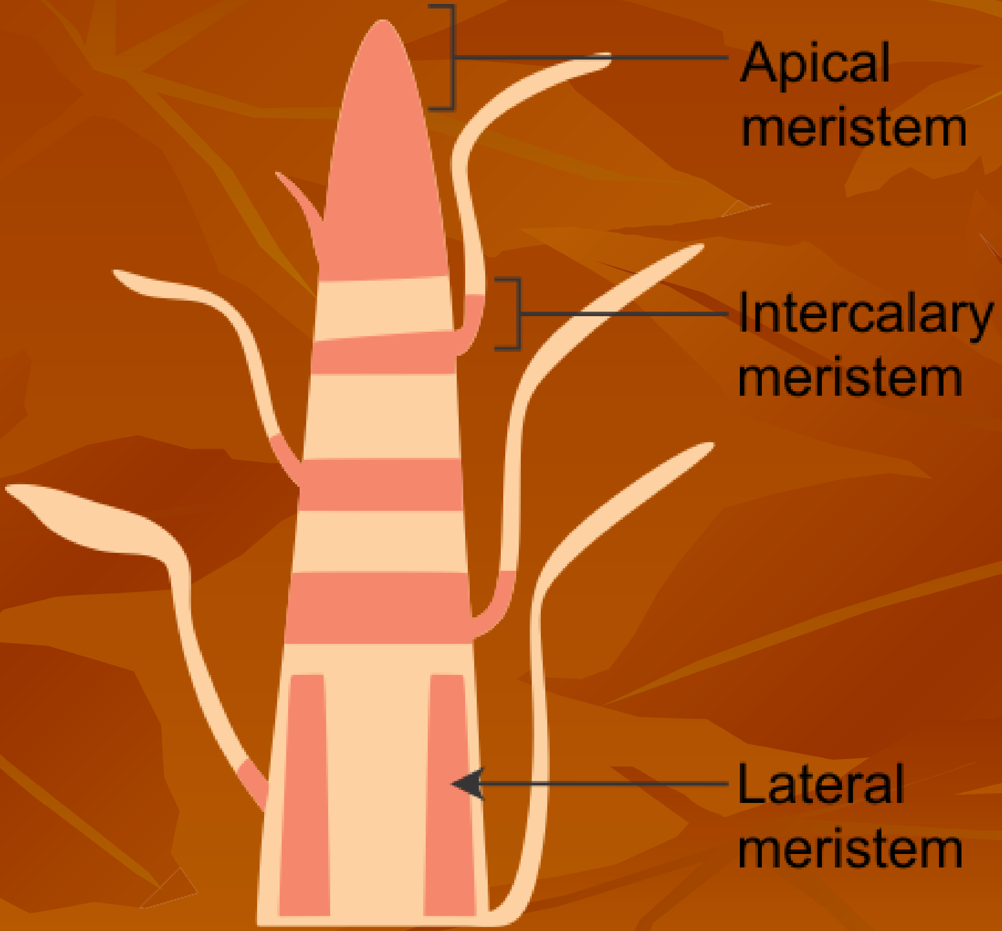


Intercalary Meristem (only in monocot stem)

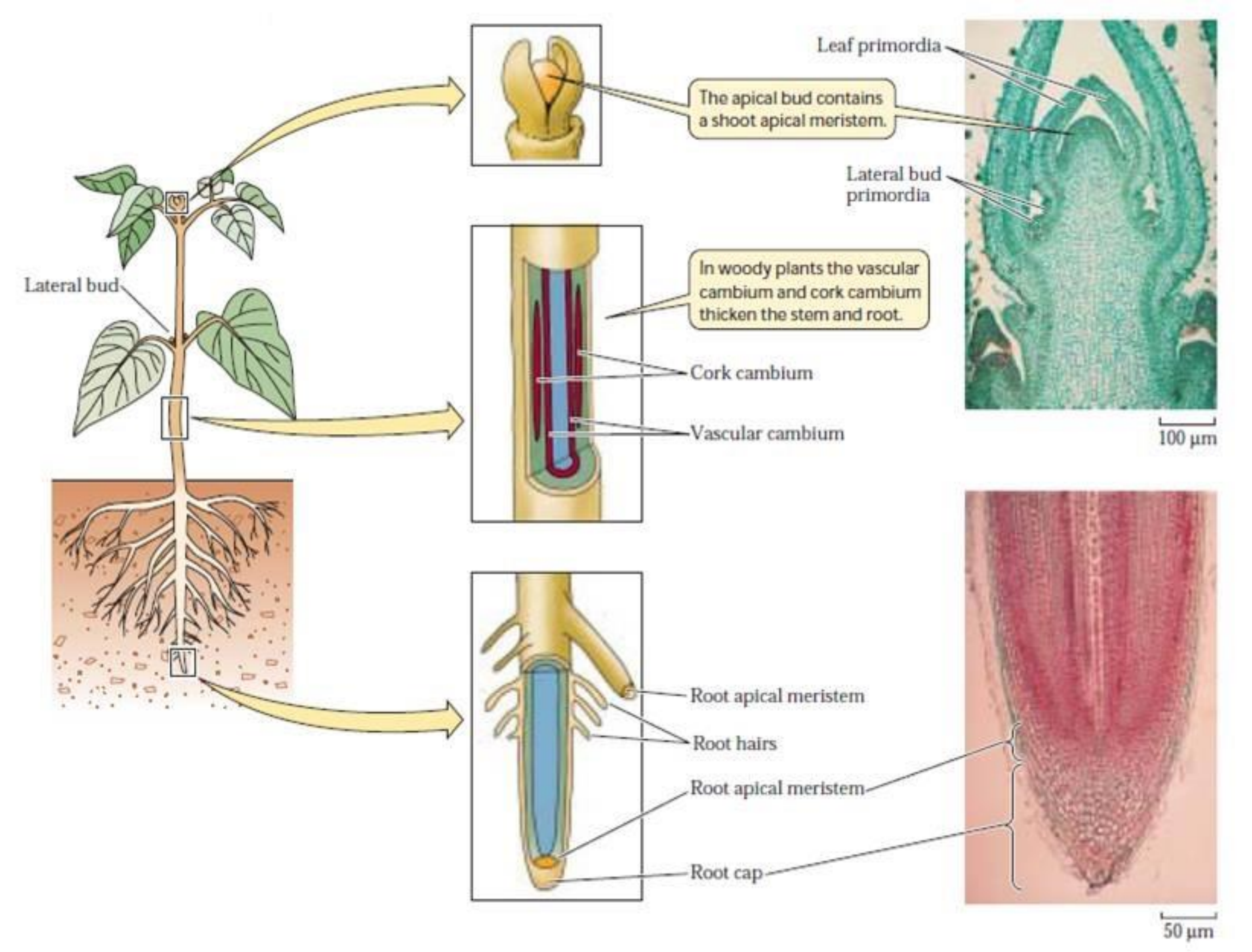
- It occurs between permanent tissues, at the base of the nodes, in monocots.
- It is also responsible for the formation of branches and leaves at the nodal regions.

Lateral meristem

- This is responsible for growth in thickness of plant body.
- Present in gymnosperms and dicots, absent in monocots.

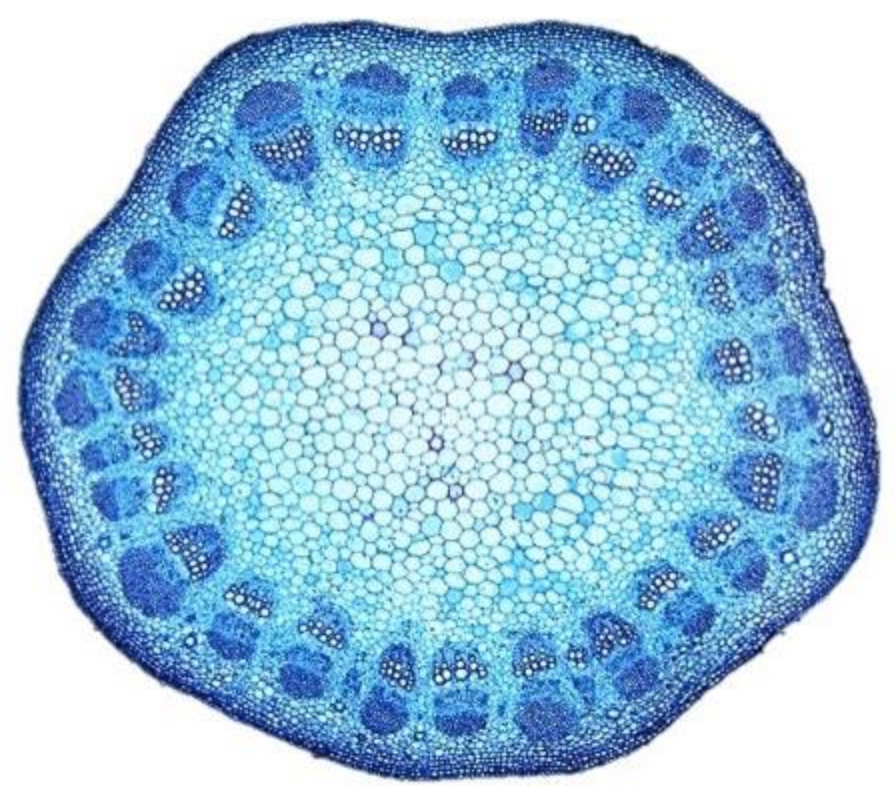


Apical and Lateral Meristems



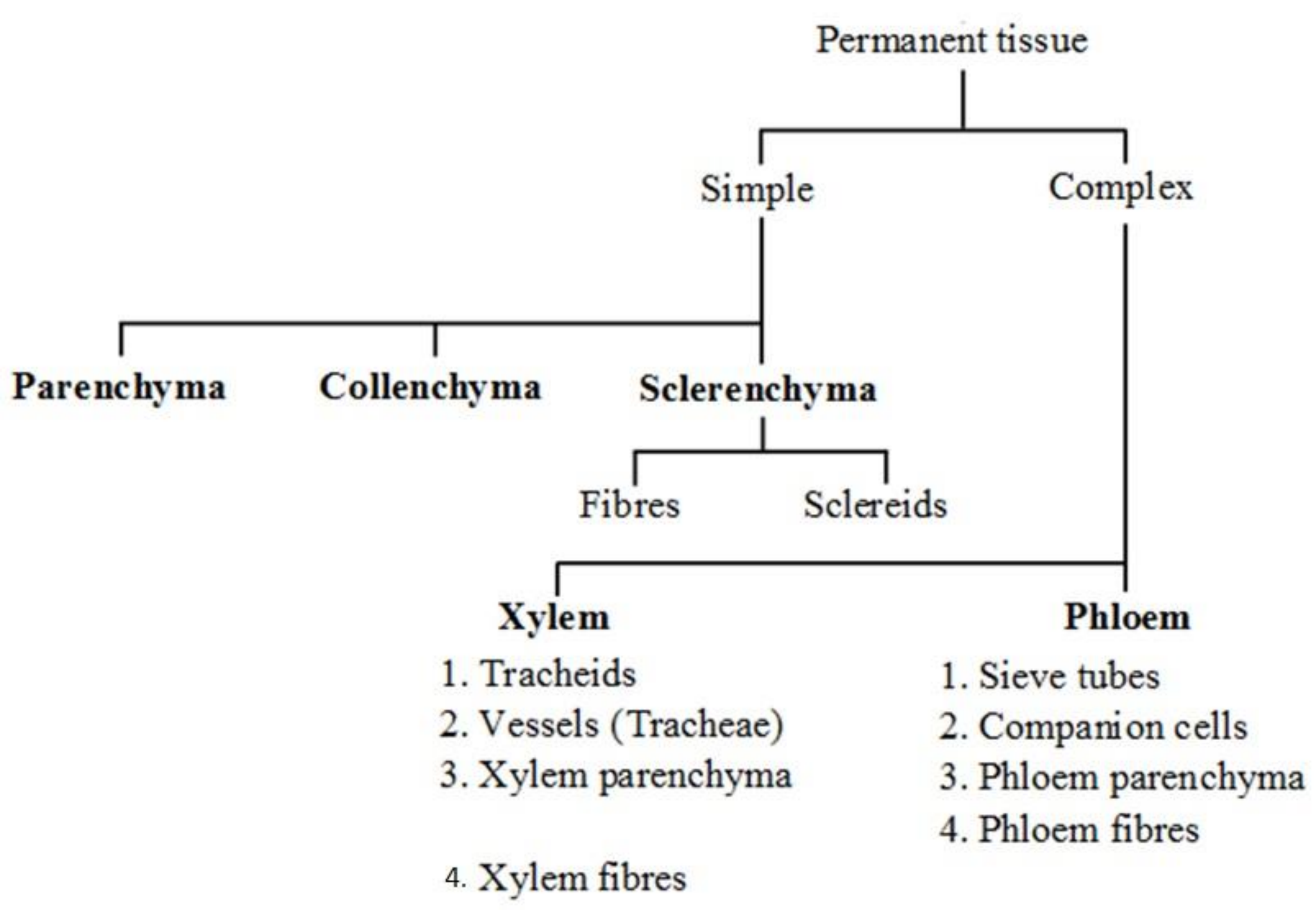
Based on origin

- **Promeristem** – Embryonic (found in seeds), forms primary meristem (during germination)
- **Primary meristem** – Forms primary permanent tissue, by *differentiation*
- **Secondary meristem** – Formed from secondary meristem, by *dedifferentiation*



Based on Differentiation;

- Protoderm (It is the meristem that always differentiates into protective structures like epidermis).
- Ground meristem (It is the meristem that differentiates into ground tissue components such as cortex, endodermis, pith, etc.).
- Procambium (makes primary xylem and phloem)

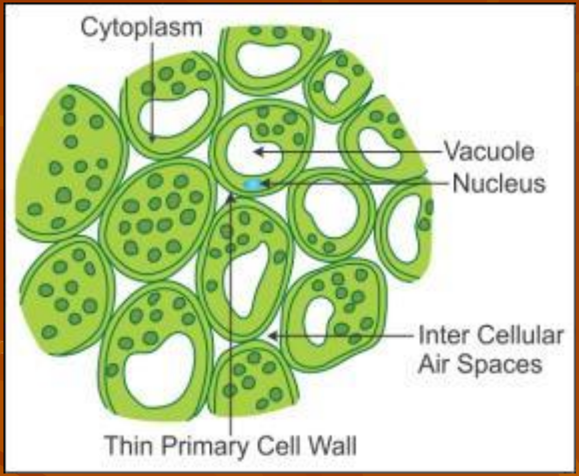


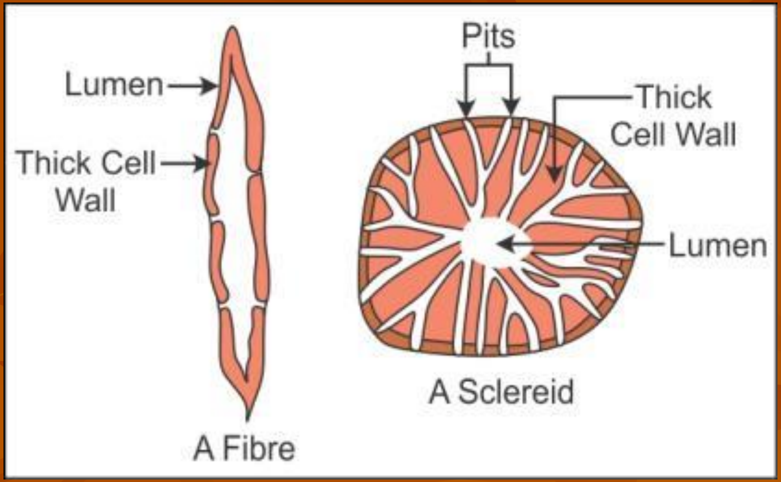
Permanent tissue

- Simple
  - **Parenchyma**
  - **Collenchyma**
  - **Sclerenchyma**
    - Fibres
    - Sclereids
- Complex
  - **Xylem**
    1. Tracheids
    2. Vessels (Tracheae)
    3. Xylem parenchyma
    4. Xylem fibres
  - **Phloem**
    1. Sieve tubes
    2. Companion cells
    3. Phloem parenchyma
    4. Phloem fibres

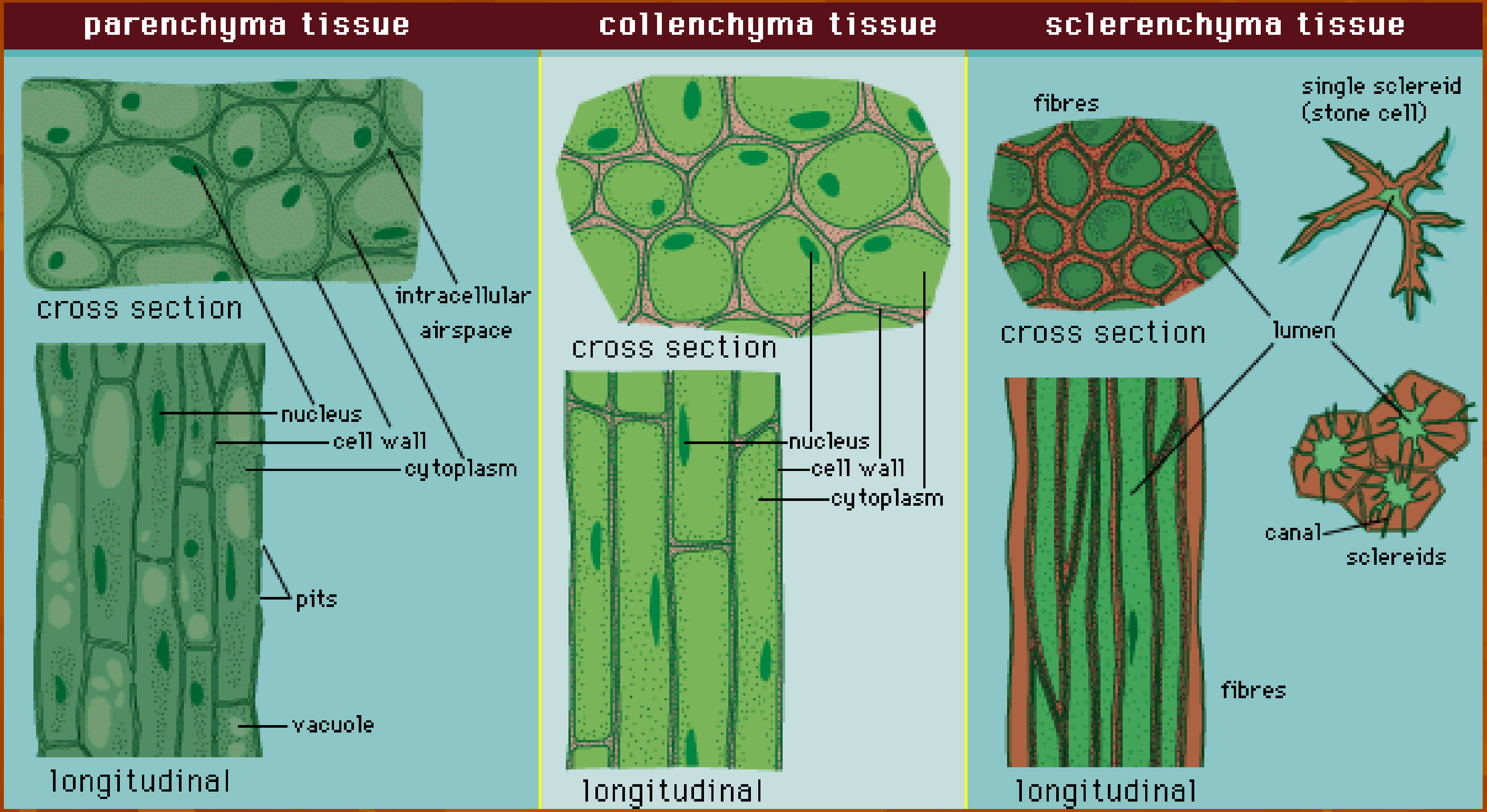
Simple permanent tissues

- Composed of same type of cells.
- *Types*
  - Parenchyma: Develops from meristem by differentiation. Can *dedifferentiate*. Packing and storage tissue.
    - Chlorenchyma (can also be collenchymatous)
    - Aerenchyma
    - Idioblast
    - Mucilaginous parenchyma
  - Collenchyma: Develops from parenchyma by growth.
  - Sclerenchyma: Mostly dead, supportive tissue
    - Sclereids/Stone cells (gritty texture of pear and guava)
    - Fibres

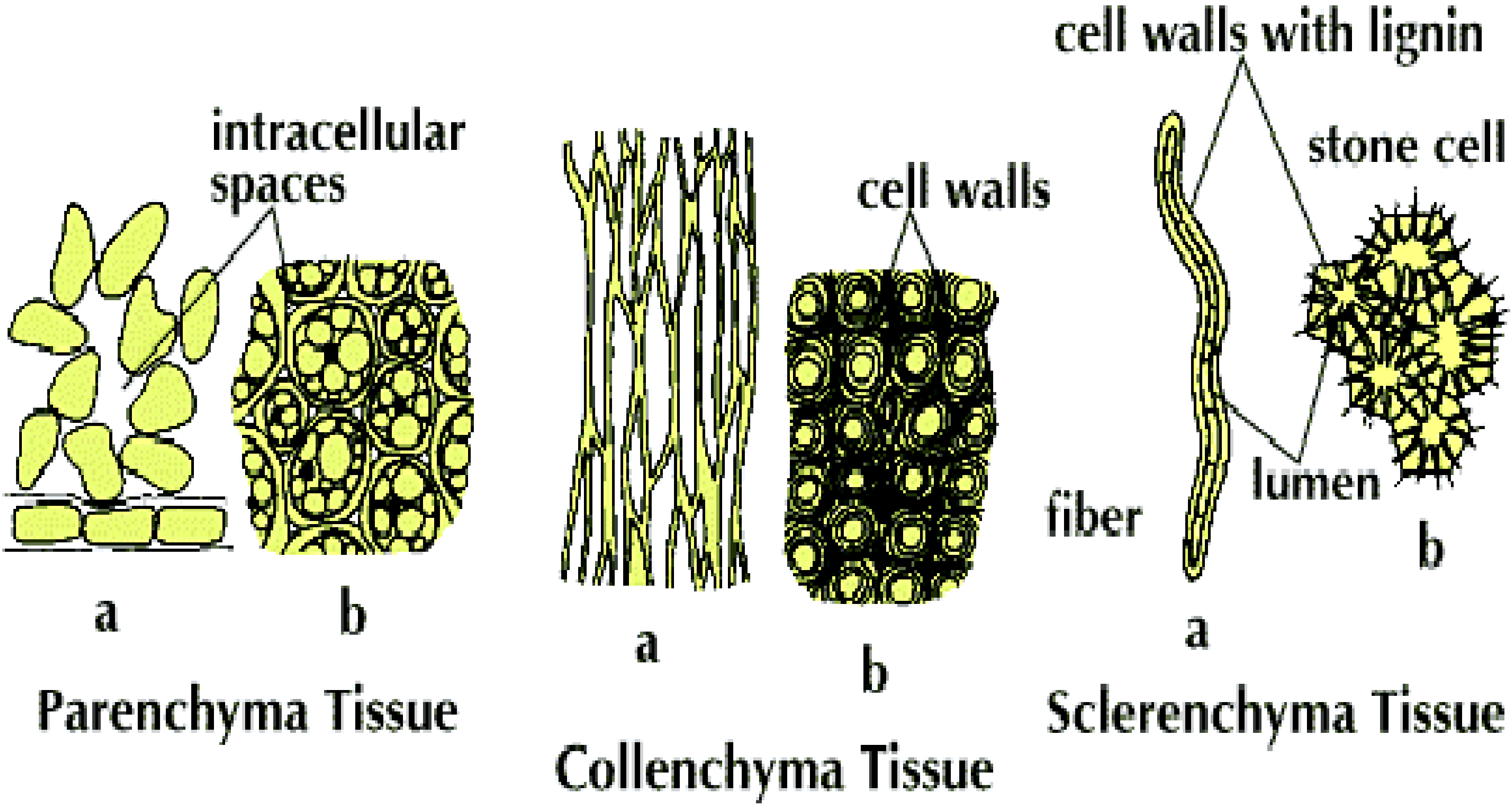




Simple permanent tissues

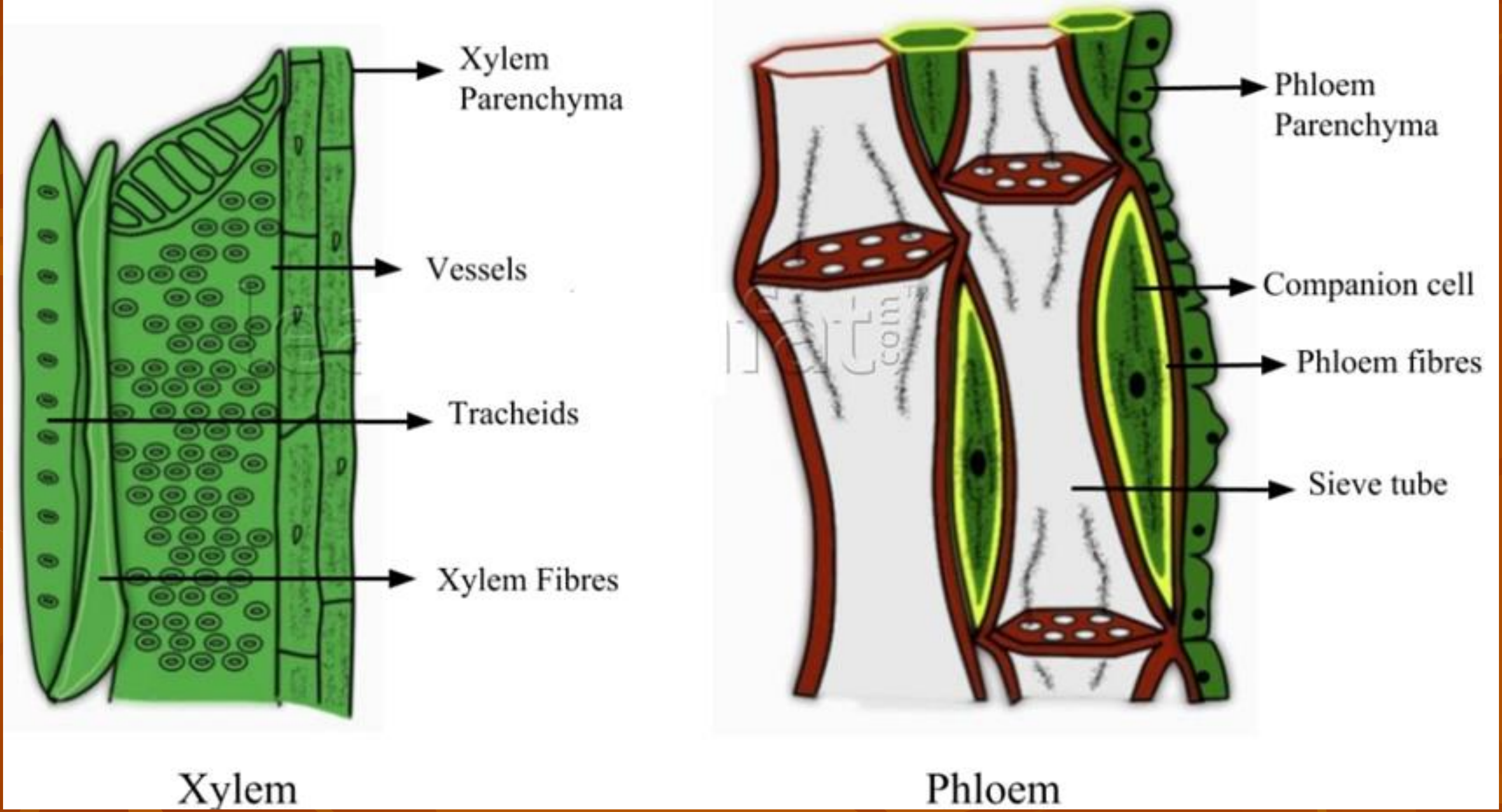


THE THREE BASIC TYPES OF PLANT TISSUE

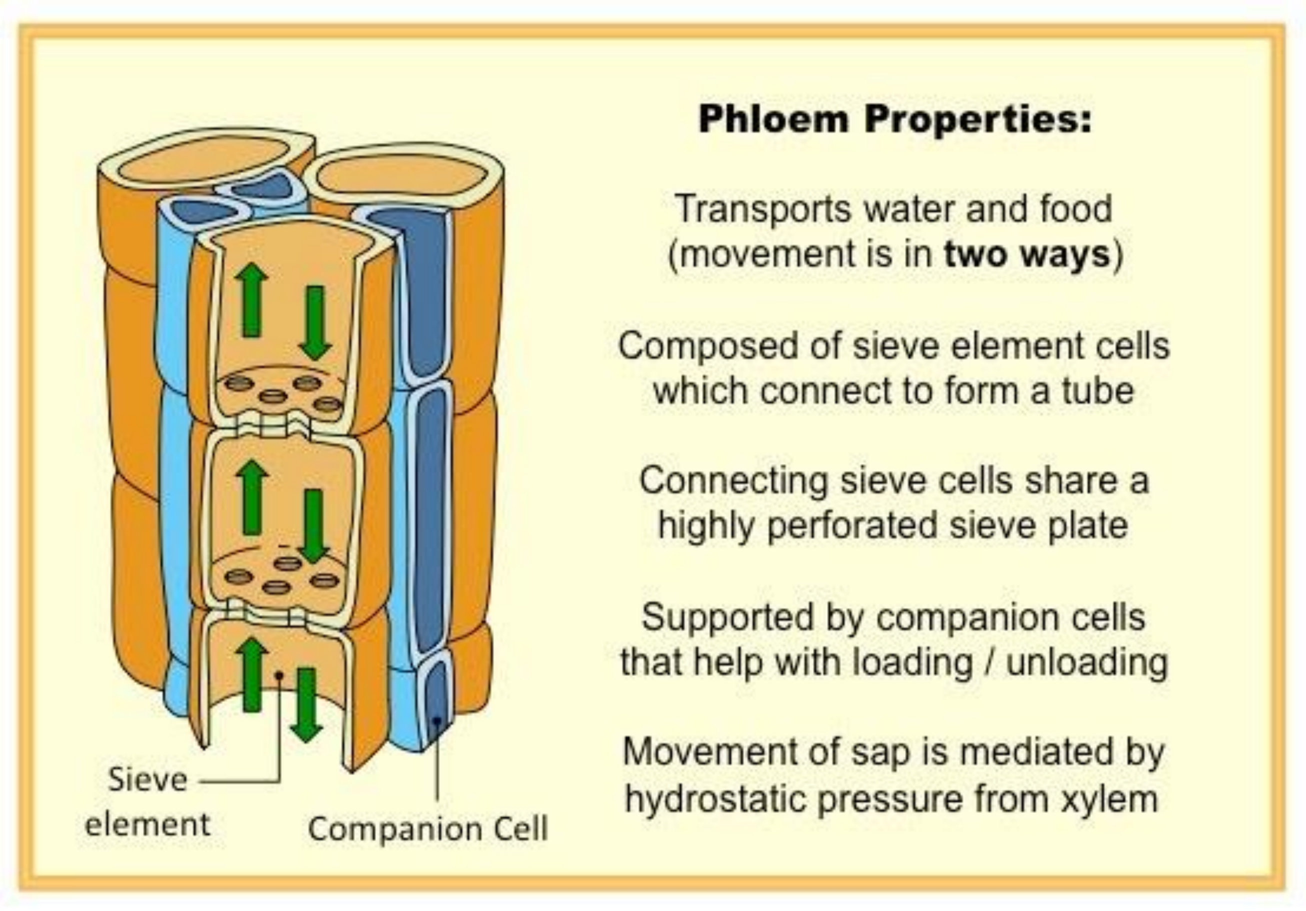


a lengthwise
b cross section

Complex Permanent Tissues



Phloem



Phloem Properties:

Transports water and food (movement is in **two ways**)

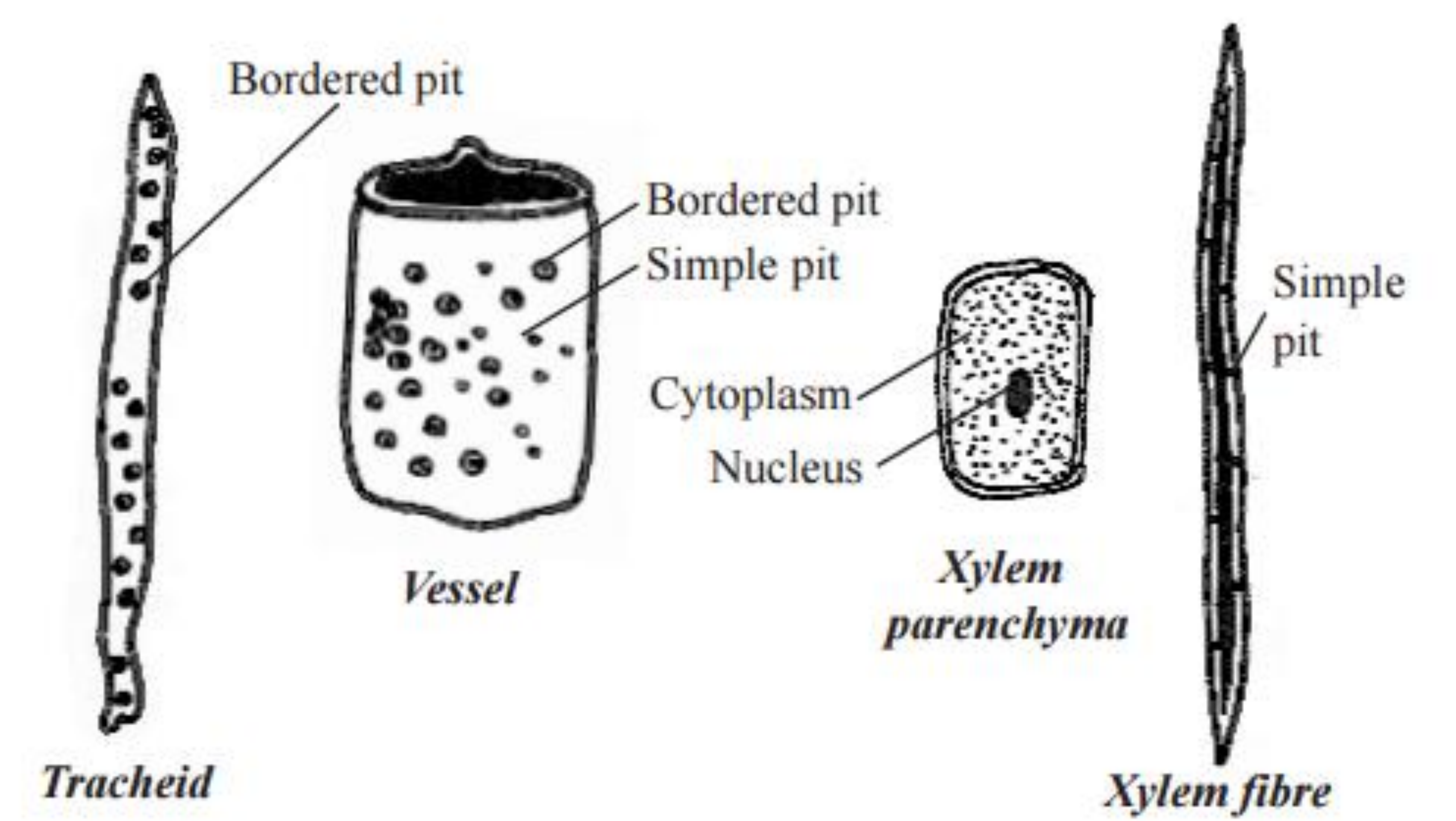
Composed of sieve element cells which connect to form a tube

Connecting sieve cells share a highly perforated sieve plate

Supported by companion cells that help with loading / unloading

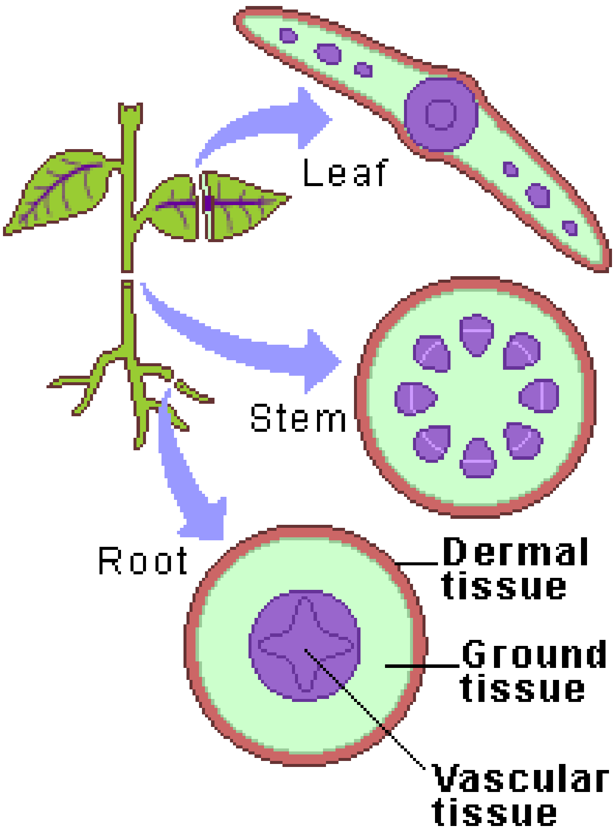
Movement of sap is mediated by hydrostatic pressure from xylem

Xylem – Components

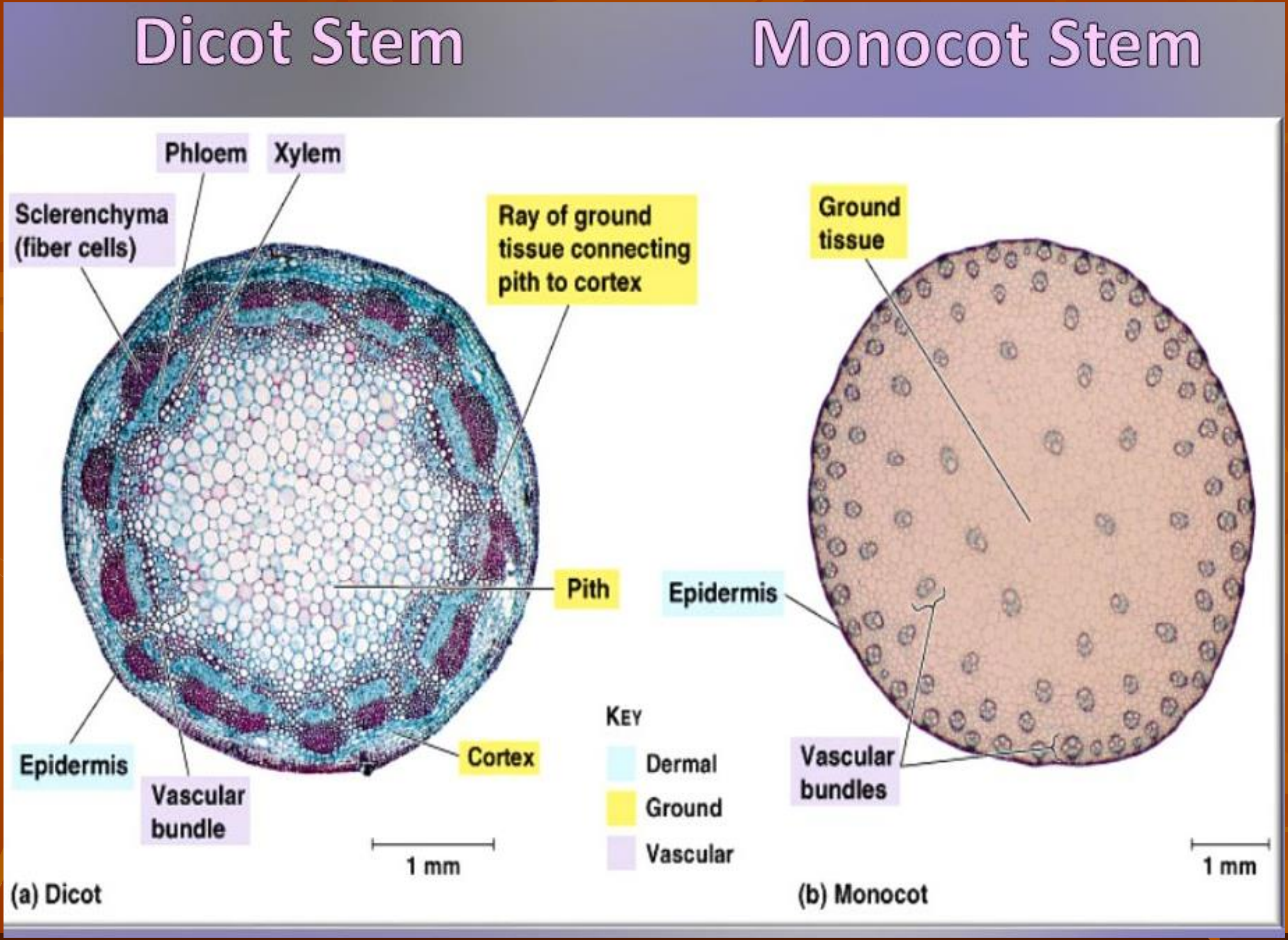


Dead components of xylem contains *lignified* secondary cell walls.

Plant Tissue Systems



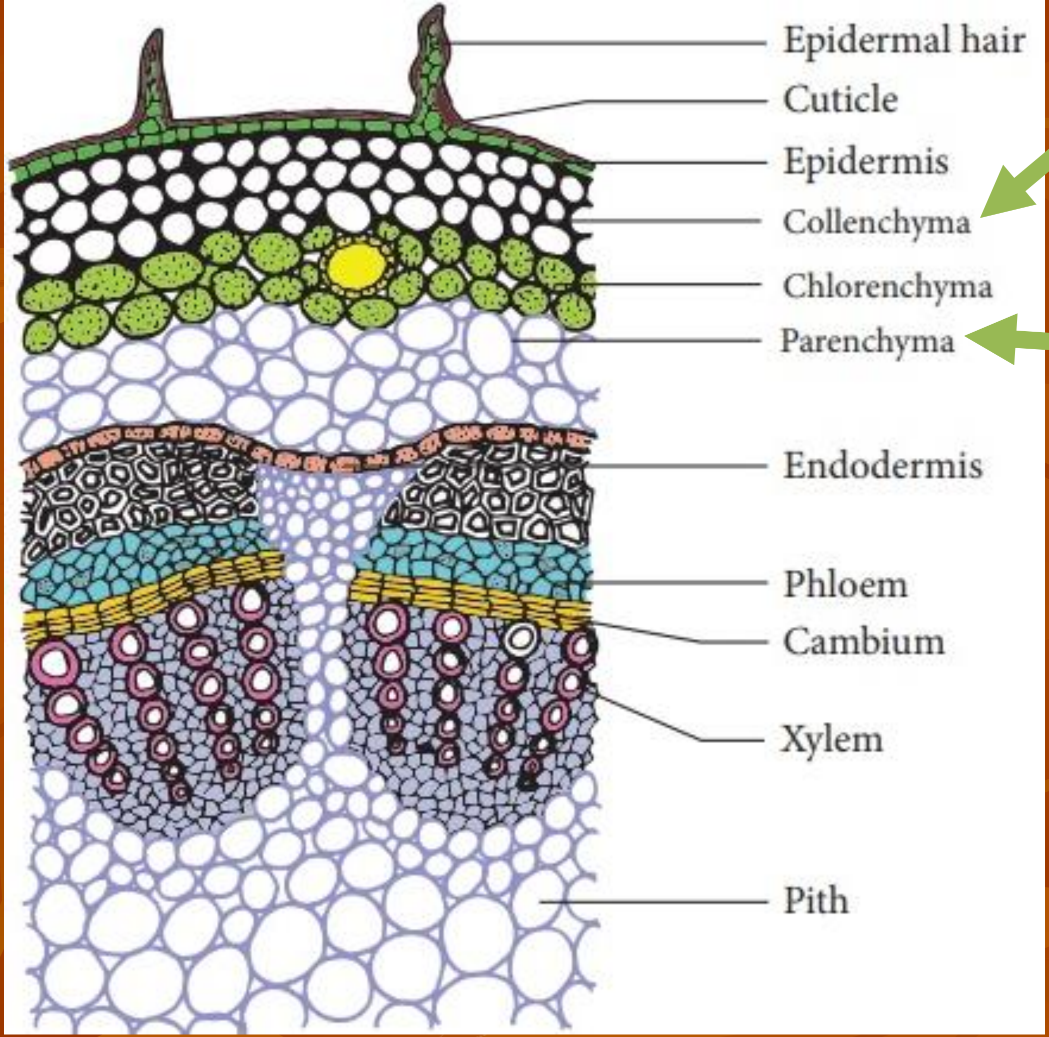
Section of Young Stem



(a) Dicot

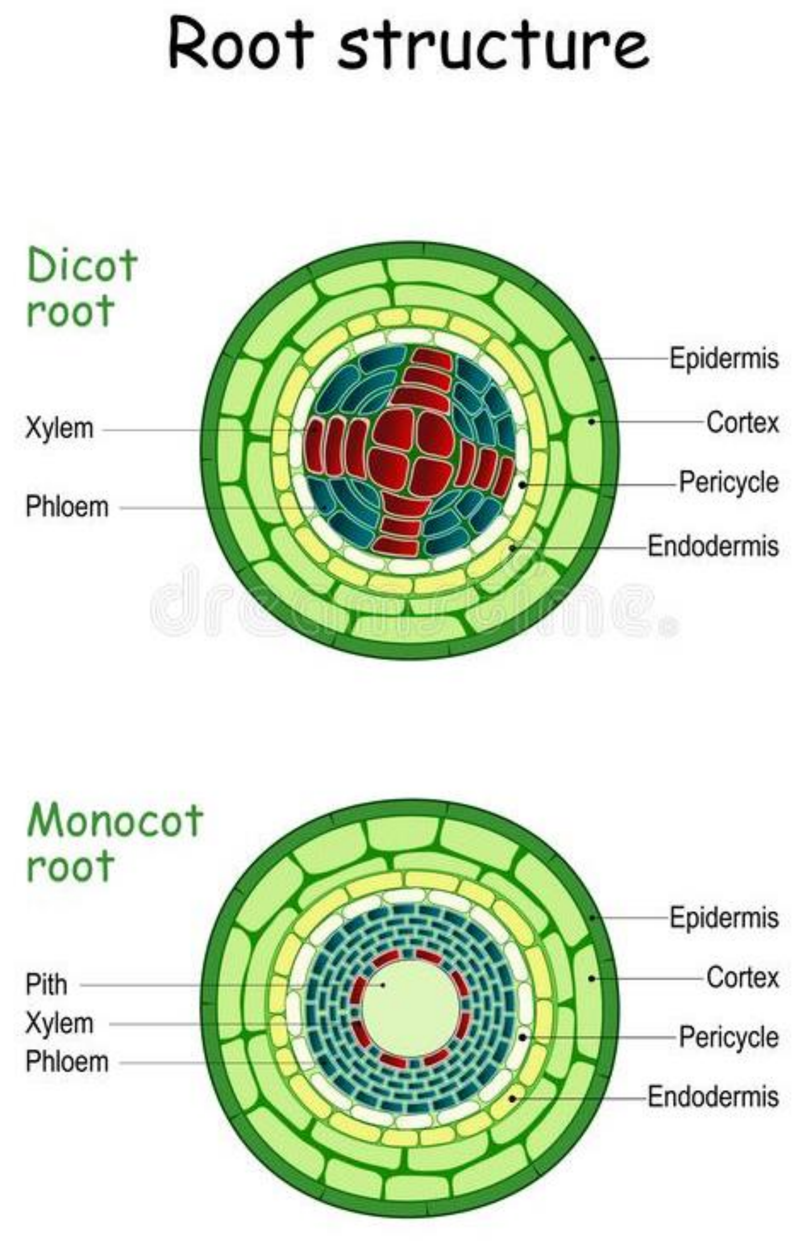
(b) Monocot

Section of Young (green) Dicot Stem



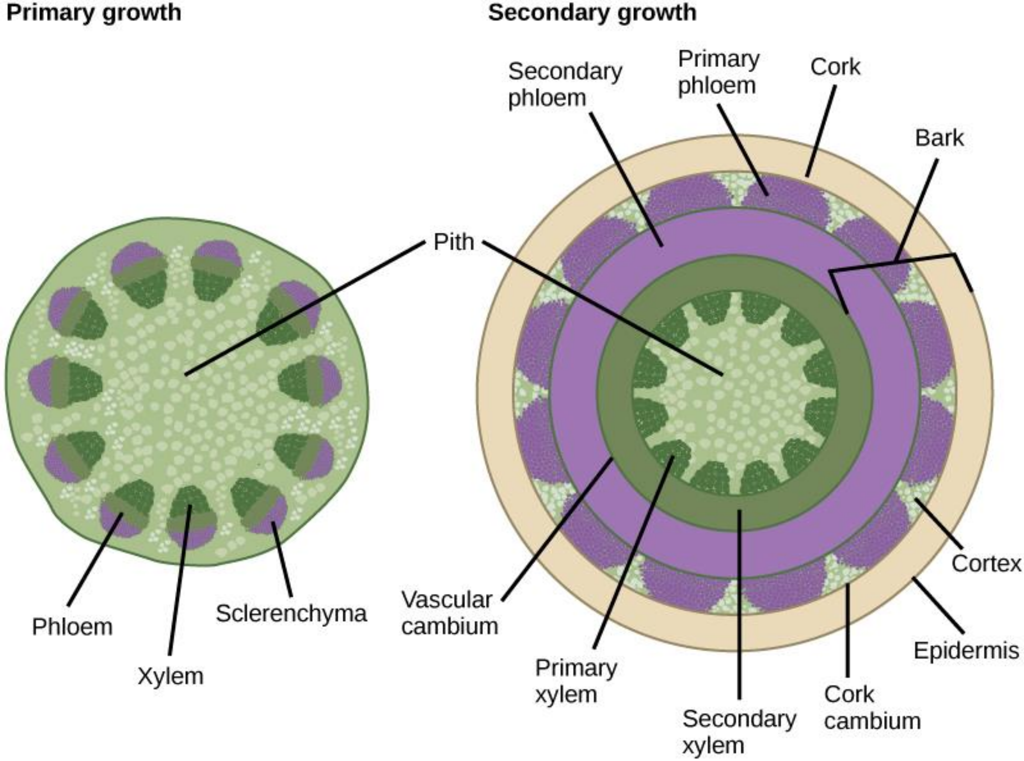
- The layer of collenchyma is termed **hypodermis**, which is absent in monocots.
- The layer of parenchyma (including chlorenchyma) is termed **cortex**.
- Epidermis and endodermis are both made up of parenchyma, but unlike normal parenchyma, they *lack intercellular space*.

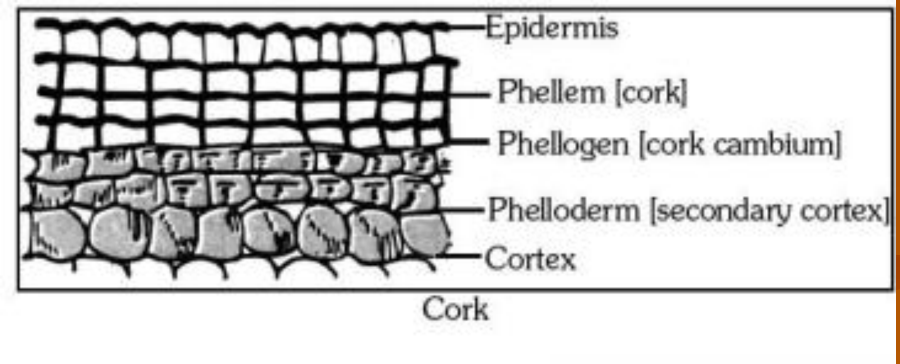
Section of Root



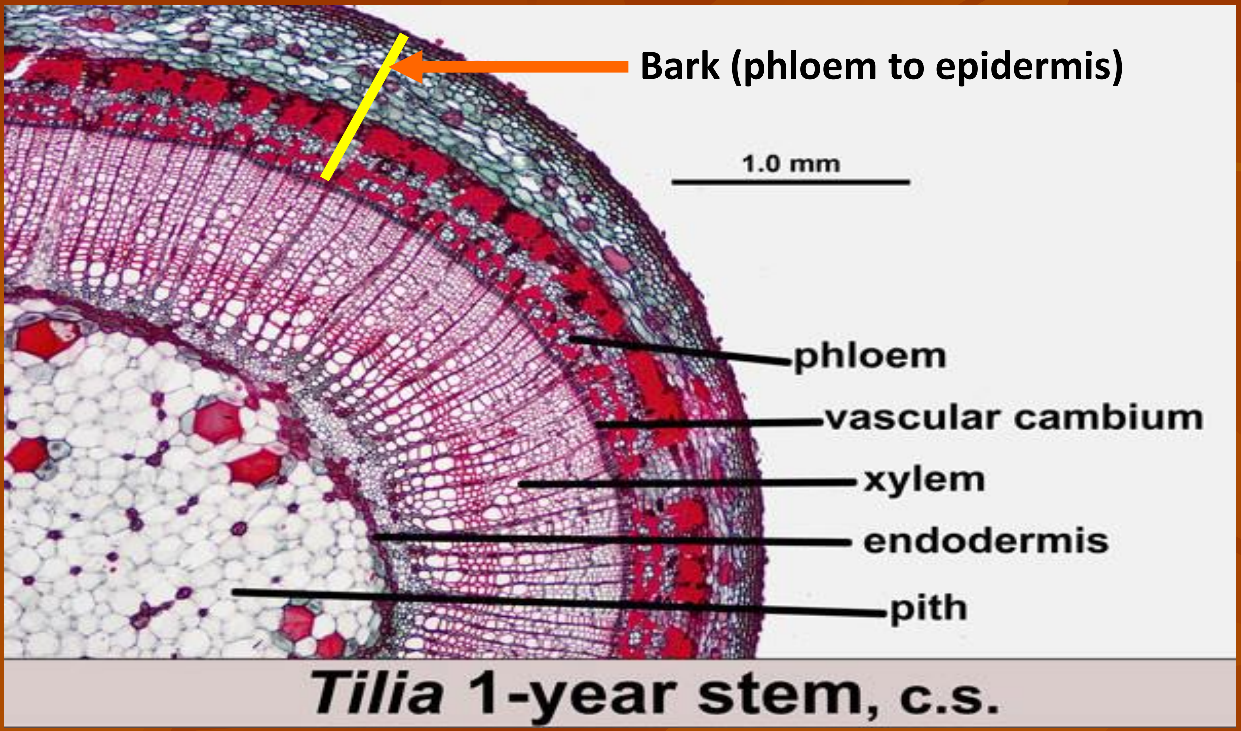
Secondary growth

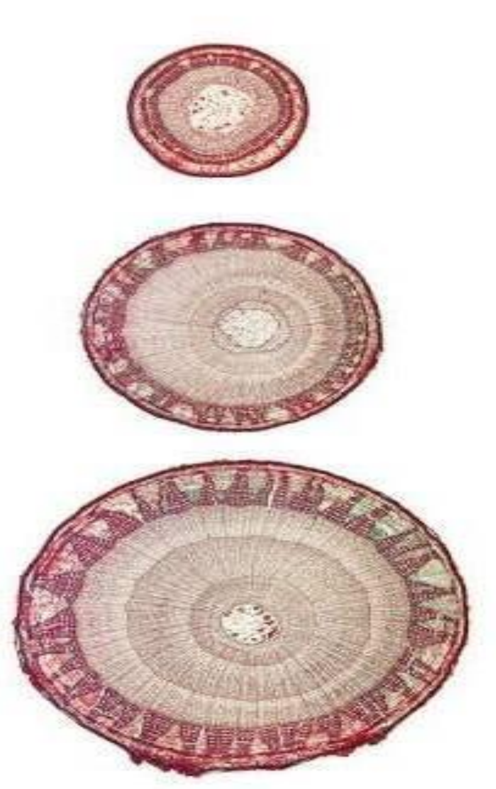
- Occurs due to secondary meristem (cambium), in dicots and gymnosperms.
- Causes increase in girth.
- *Types*
  - Cork cambium (phellogen): Produces
    1. *cork (phellem)* – outwardly. Cork cells have *suberized* cell wall.
    2. *secondary cortex (phelloderm) - inwardly.*
  - Vascular cambium (Divided into *intra-fascicular* and *inter-fascicular* cambium : *Just know the names, don't lose your heads*) : forms secondary vascular bundles





Lateral Meristems – secondary growth in woody plants





Basswood – stem in cross section; 1, 2, 3 year old stems

Note: Trunk of a woody tree does not grow in height (Can you explain why?), only it grows in thickness. So if a tiger scratches a tree bark, the height of the scratch remains the same even after multiple years. The scratch marks may get distorted due to secondary growth but are not completely removed as shedding and renewal of *bark* is a slow process. *Wondering what is bark?* It is a non-technical term for all tissues outside of vascular cambium in a woody stem or root (see pic above and on page 25)

Protective Tissues – Epidermal Tissue System

✓ Epidermis is the continuous outer covering of a plant.

✓ Made up of *single layer of parenchymatous cells*.

✓ Epidermis of aerial parts of plants (stem, leaf, etc.) has an external waxy coating *(pic on Page 23)* – cuticle (which is absent in roots), to reduce water loss.

Q. Can you guess the characteristics of cuticle in desert plants?

✓ Epidermis also has extensions – trichomes (multicellular stem hairs- *pic on Page 23*) and unicellular root hairs.

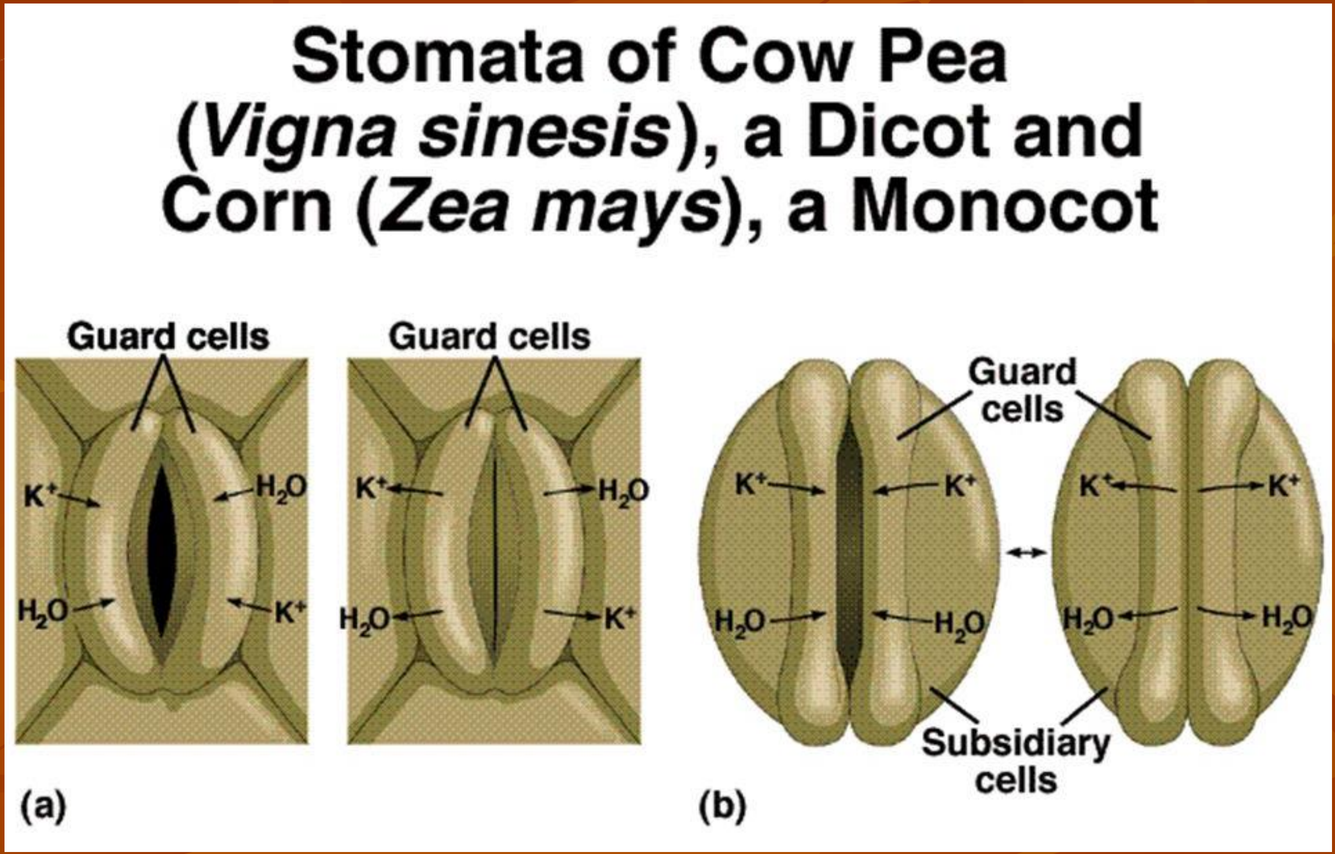
✓ Leaf epidermis has minute openings for gaseous exchange – stomata.

✓ Stomatal opening and closing are regulated by guard cells.

✓ Guard cells are the only epidermal cells having chloroplasts.

✓ Stomata are more on the dorsal (lower) surface of leaf.

Stomata and Guard Cells



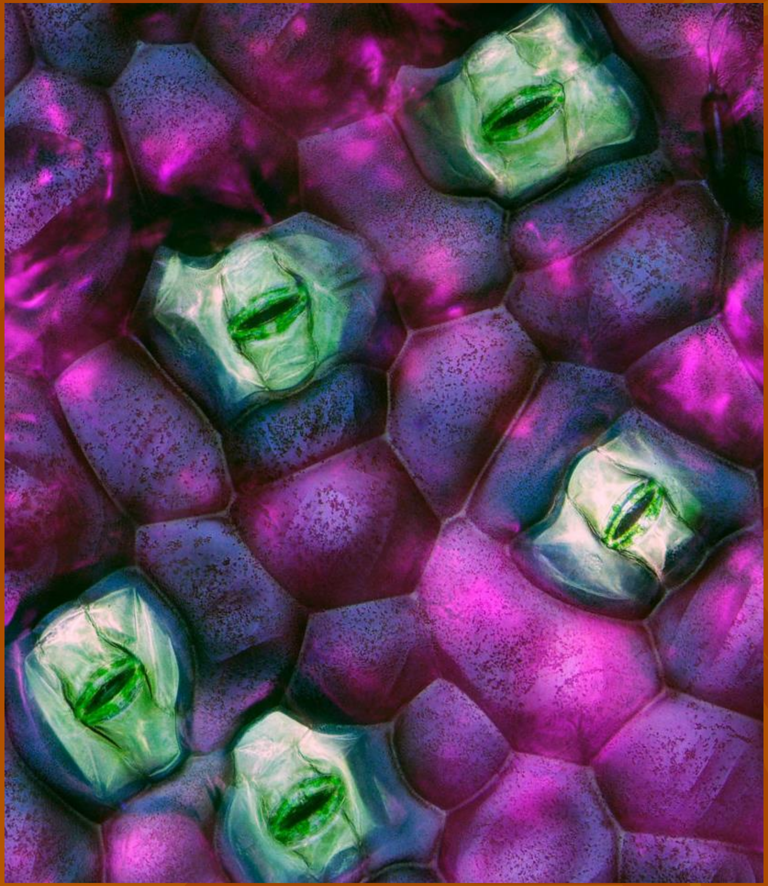
Stomata of Cow Pea (*Vigna sinesis*), a Dicot and Corn (*Zea mays*), a Monocot

- Dicot : **Bean shaped** guard cells
- Monocot : **Dumbell-shaped** guard cells
- Guard cells turgid (due to endosmosis) - stoma opens
- Guard cells flaccid (due to ?) - stoma closes

Stomata and Guard Cells – under microscope

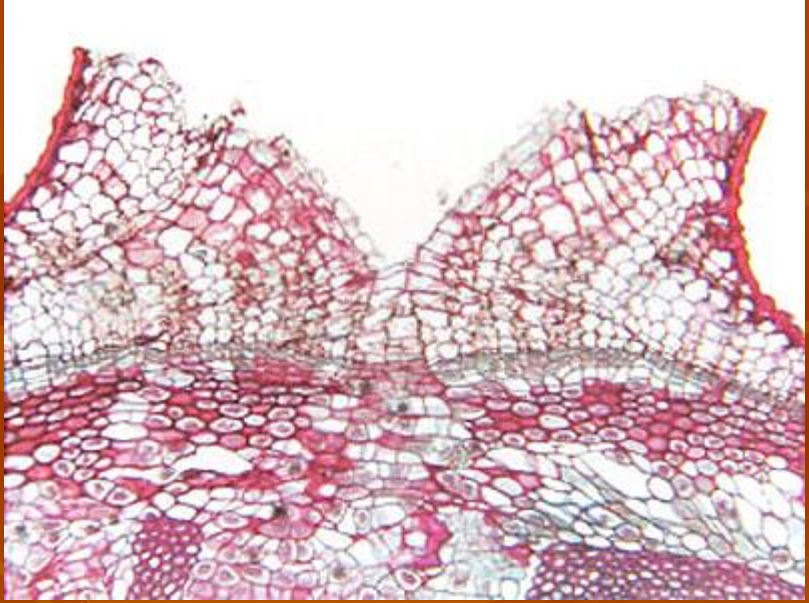
Q1. Are the stomata open or closed?
Q2. Is this a dicot or monocot?

This is from the epidermis of *Tradescantia* leaf, where most epidermal cells are purple in colour.
Q3. Can you explain why this leaf is preferred for microscopic stomatal studies?

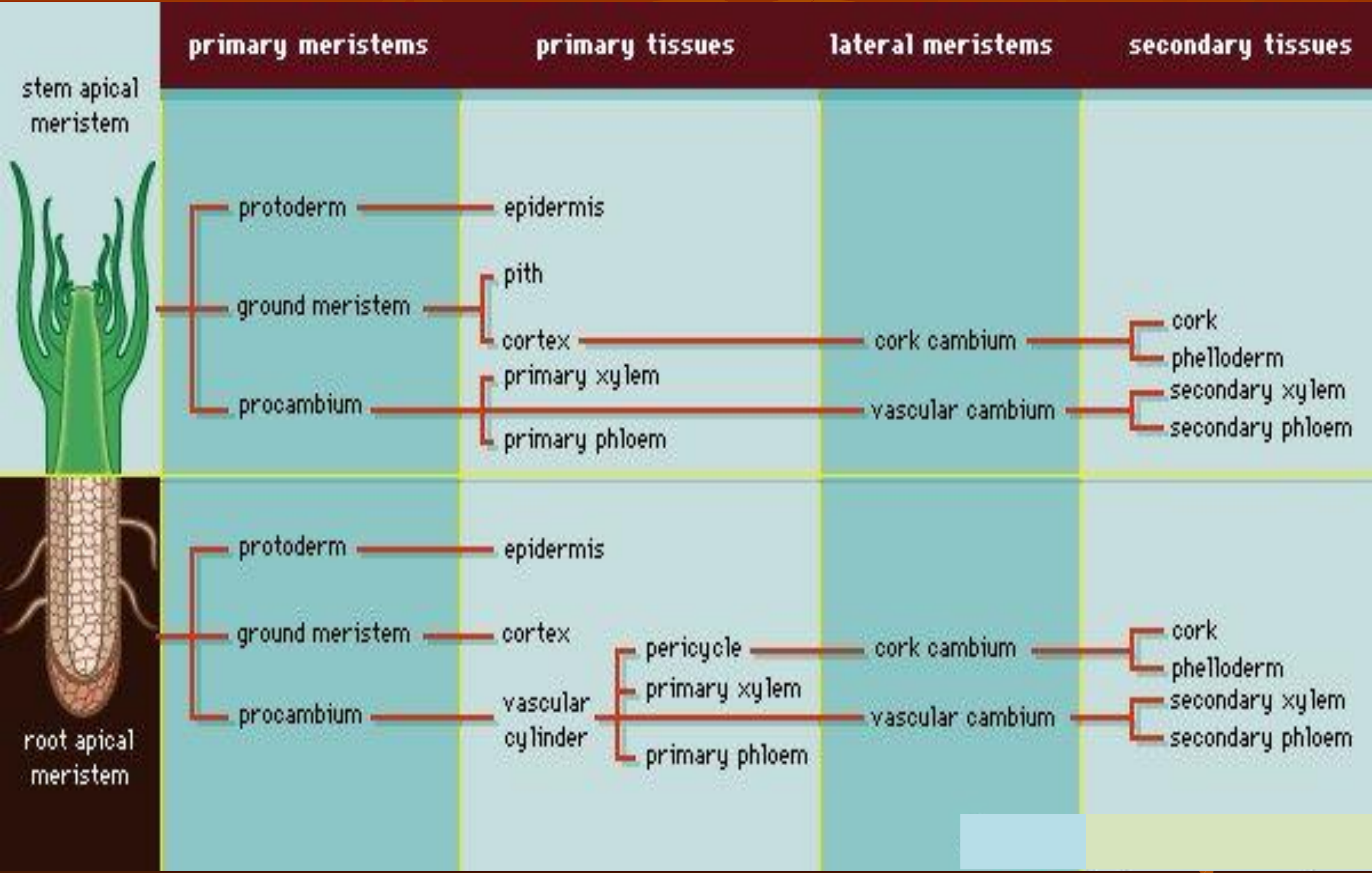


Lenticel

- Due to secondary growth (cork and secondary cortex) in woody stems and roots, the epidermis breaks at points forming minute openings called *lenticels*.
- These take part in gaseous exchange.



Development of Various Plant tissues



	primary meristems	primary tissues	lateral meristems	secondary tissues
stem apical meristem	protoderm	epidermis		
	ground meristem	pith		
		cortex	cork cambium	cork phelloderm
	procambium	primary xylem primary phloem	vascular cambium	secondary xylem secondary phloem
root apical meristem	protoderm	epidermis		
	ground meristem	cortex		
	procambium	vascular cylinder: pericycle	cork cambium	cork phelloderm
		vascular cylinder: primary xylem primary phloem	vascular cambium	secondary xylem secondary phloem